# FLOW AND PRESSURE REGULATING DEVICES FOR FIRE PROTECTION SERVICE

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## 1.0 SCOPE

This data sheet provides guidelines for the identification, sizing, selection, installation, and inspection, testing, and maintenance (ITM) of flow-reducing and pressure reducing valves in automatic sprinklers and hose systems. This data sheet also includes guidance for automatic breach containment valves (also known as "automatic breach control valves" or "breach valves").

For the purposes of this data sheet, "pressure reducing valve" applies to a valve that reduces a high inlet fluid pressure to a lower outlet pressure in both the static (no-flow) condition and the flowing (residual) condition. These are sometimes referred to as "pressure-regulating valves" and these terms are used interchangeably in this document. Automatic breach containment valves (ABCVs) are valves designed to completely stop the flow of water in a fire protection system in the event of a breach or line break.

Refer to the following Data Sheets for guidance:

A. See Data Sheet 3-7, *Fire Protection Pumps*, for guidance on the following equipment when part of a fire pump installation:

- Pressure relief valves
- Suction Regulating valves
- Flow and/or pressure reducing valves

B. See Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*, when the following are part of sprinkler systems:

- Pre-action pressure reducing valves
- Deluge pressure reducing valves
- Pressure relief valves in sprinkler piping

For the purposes of this data sheet, the use of the term "valves" applies to both pressure reducing and automatic breach containment valves, unless otherwise stated.

### 1.1 Hazards

Pressure reducing valves are valves that maintain the downstream pressure at a lower set pressure. Typically, they are installed in fire protection systems where the system pressures exceed 175 psi to bring the pressures down below that level to avoid component failure.

There is a subset of valves designed to interrupt flow when downstream pressure falls to a lower limit. An example is an automatic breach control valve.

Because these valves operate by restricting the flow of fire protection water through them, they can obstruct the supply of fire protection water. This can reduce the effectiveness of sprinklers, or even prevent sprinklers and hoses from operating in an emergency.

### 1.2 Changes

**January 2023.** Interim revision. Changes include the following:

A. Renamed Section 2.3 to Protection.

B. Relocated existing sections 2.2.2 and 2.2.3 to Section 2.3, Protection.

C. Updated installation guidance for pressure reducing valves in system designs.

D. Updated requirement for flow and pressure testing where pressure reducing valves are installed.

E. Changed the inspection and testing requirements in Table 2.4.1.2-1.

F. Minor editorial corrections.

## 2.0 LOSS PREVENTION RECOMMENDATIONS

### 2.1 Introduction

2.1.1 Use FM Approved equipment, materials and services whenever they are applicable. For a list of products and services that are FM Approved, see the *Approval Guide*, an online resource of FM Approvals.

### 2.2 Construction and Location

#### 2.2.1 General

2.2.1.1 Locate all valves in dry areas that are readily accessible by personnel.

### 2.3 Protection

#### 2.3.1 General

2.3.1.1 Provide the following for all valves in use:

A. Operation charts for all models of valves used. These are to be available on site for reference.

B. A permanently attached placard for each valve in use that indicates:

- Valve setting pressure
- Flow and inlet pressure used in setting the outlet pressure
- The sprinkler system design flow and pressure requirements at the valve outlet

#### 2.3.2 Pressure Reducing Valves

2.3.2.1 Do not install pressure reducing valves on sprinkler systems where the static inlet pressure is 175 psi (12.1 bar) or less.

2.3.2.2 Do not install pressure reducing valves in storage and manufacturing occupancies.

2.3.2.3 Minimize the use of pressure reducing valves in all other occupancies.

An example is a high rise building where the lower floors may need a pressure reducing valve; but once the pressure on upper floors is 175 psi (12.1 bar) or less, pressure reducing valves are not needed. In some cases, the installation of additional fire pumps can minimize the number of pressure-reducing valves.

2.3.2.4 Size pressure reducing valves on hose systems/hose valves, where required by local conditions, in accordance with their intended application. Sizing of these valves is discussed in Section 3.

2.3.2.5 Do not use pilot-operated pressure reducing valves downstream of a dry-pipe or preaction valve.

As the pressure reducing valve requires the upper chamber (cover chamber) to be full of water for proper operation, installing a pressure reducing valve downstream of the dry-pipe or preaction valve can defeat the purpose of a dry-pipe or preaction system.

2.3.2.6 Install pressure-reducing valves in the orientation specified by the manufacturer's guidelines.

2.3.2.7 Maintain on-site any special tools that are required to adjust the settings of field-adjustable valves if valves are adjusted by on-site personnel. Access to these tools is to be controlled.

#### 2.3.3 Automatic Breach Containment Valves

2.3.3.1 Do not install automatic breach containment valves (ABCV's) in fire protection systems. If local codes/requirements are referenced as requiring the installation of these valves, request the local code/requirement for evaluation.

2.3.3.1.1 Remove existing automatic breach containment valves where they are installed. If local codes/requirements are referenced as requiring the installation of these valves, request the local code/requirement for evaluation.

### 2.3.4 Pressure Reducing Valves in Fire Protection Water Supply Distribution Piping

2.3.4.1 When a pressure reducing valve is needed to reduce non-fire service water pressures, it should be independent/separate from the fire system.

2.3.4.2 Arrange any pressure reducing valve needed in a connection where the fire water and non-fire water is combined, to allow isolation of the non-fire water connection without affecting the fire water connection.

2.3.4.3 Provide a bypass loop around the pressure reducing valves, with a normally closed indicating control valve, to allow water for fire protection to be available in the event the pressure reducing valves are out of service. The bypass line is to be of the same size as the main line.

2.3.4.4 If the system is such that water hammer or cavitation can occur at low flows, or if the pressure reducing valve will not provide accurate pressure regulation at low flow, then install a second pressure reducing valve in parallel.

2.3.4.5 If the minimum required flow of the valve, is higher than what would be flowed during the regular sprinkler system alarm testing, e.g. Inspectors Test Connection, then provide a secondary pressure reducing valve in parallel. Size and set this secondary valve to handle 125% of the minimum flow of the primary.

2.3.4.6 When installing pressure reducing valves in a fire service main (Figure 2.3.4.6-1) apply the following guidance:

A. Install check valves to allow each pressure reducing valve to be isolated for maintenance.

B. Maintain the indicating control valve used for isolation of the bypass loop around the pressure reducing valves in a normally closed position.

C. Locate any water flow meters on the outlet side of pressure reducing valves.

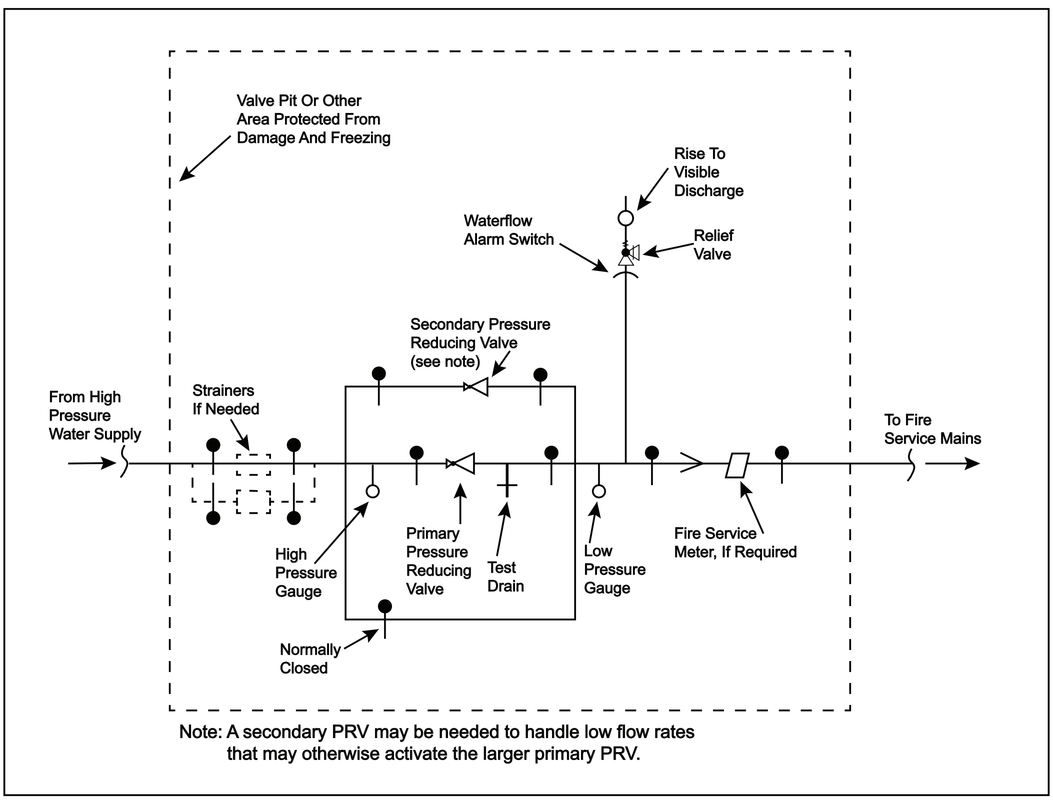


*Fig. 2.3.4.6-1. Arrangement of pressure reducing valve for fire service*

2.3.4.7 Provide a test drain on the downstream side of the pressure reducing valve sized for the flow and pressures expected during a full flow test of the valve.

### 2.3.5 Pressure Reducing Valves in Individual Sprinkler Systems

2.3.5.1 Arrange the valve installation as shown in Figure 2.3.5.1-1, when pressure reducing valves are installed in sprinkler systems.

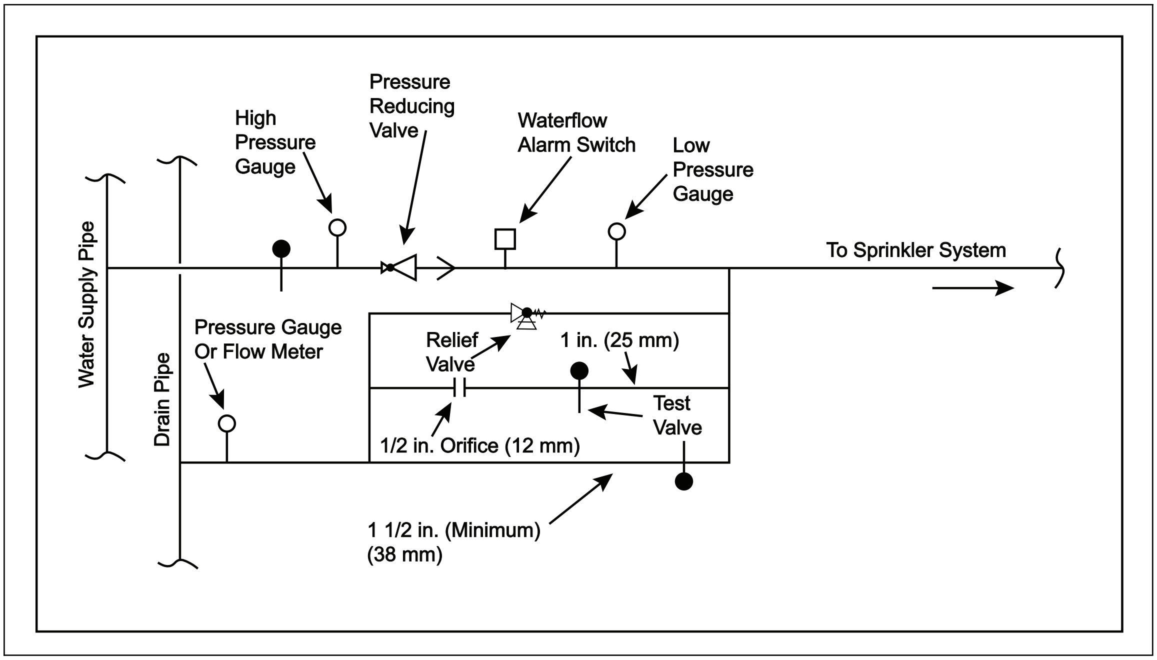


*Fig. 2.3.5.1-1. Pressure reducing valve installation for individual sprinkler system (Note: A check valve is not needed for pressure reducing valves that have a check valve function incorporated in their design.)*

FM Approved pressure reducing valves are required to be installed with an Approved trim pressure relief valve.

2.3.5.2 Size the pressure relief valve and associated piping on the outlet of the pressure reducing valve in accordance with Section 3.0. Set the pressure relief valve at a point less than the pressure rating of the downstream system components and at a point that will identify that the valve is not working properly. Consult the valve manufacturing specifications as part of this process.

This will enable a leaking pressure reducing valve to be detected and repaired.

2.3.5.3 Provide the ability to fully flow test the pressure reducing valve to the highest demand of the fire protection system. Drains are to be sized to handle the full flow testing of the pressure reducing valve.

Acceptable methods for testing include, but are not limited to, the following:

- A permanent test line and drain (or drain riser)
- An inline flow meter
- External clamp-on flow meter

### 2.3.6 Direct Acting Pressure Reducing Valves in Hose Connections

2.3.6.1 Install a test gauge on the gauge outlet provided upstream of the hose connection. Connect the pressure reducing valve outlet to the test drain connection using a test line provided with a gauge for measuring the pressure reducing valve outlet pressure; a flowmeter; and a gate valve for controlling the flow (Figure 2.3.6.1-1).

### 2.3.7 Pressure Reducing Valves on Standpipe Systems

2.3.7.1 Install pressure reducing valves on the hose outlet/standpipe system.

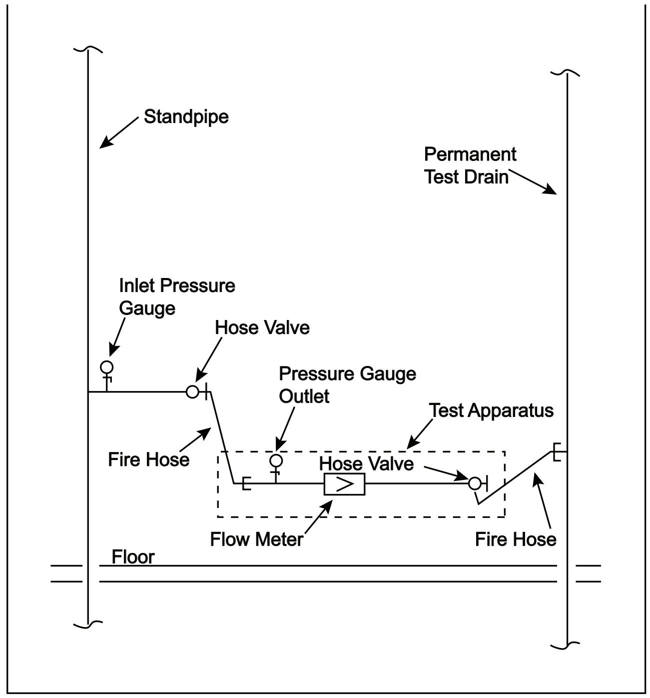


*Fig. 2.3.6.1-1. Arrangement of annual full flow test on valves used in hose connections*

2.3.7.2 Provide a valved outlet for a pressure gauge on the upstream side of the hose connection, to allow for a test gauge. This gauge outlet is needed for testing and use of the pressure reducing valve installed at the hose connection.

2.3.7.3 Provide a means for full flow testing of the devices.

## 2.4 Operation and Maintenance

### 2.4.1 Pressure Reducing Valves - Inspection, Testing, and Maintenance (ITM)

2.4.1.1 Test all pressure regulating valves upon installation.

2.4.1.2 Inspect all pressure reducing valves as stated in Table 2.4.1.2-1.

*Table 2.4.1.2-1. Test Frequency for Pressure Reducing Valves Installed in Fire Protection Systems*

| ID | Recommendation | Frequency | Details |
|---|---|---|---|
| 1a | Visually inspect pressure reducing valves. | Quarterly | - Confirm downstream pressure is maintained by the valve as designed<br>- Report signs of leakage<br>- Record visual inspection results on a form listing all pressure reducing valves, their location and area controlled |
| 1b | Conduct partial flow testing of pressure reducing valves | Annually | - Establish flow through the pressure reducing valve by flowing the inspector's test connection or the main drain located downstream of the pressure reducing valve.<br>- Ensure the valve moves from the valve seat and maintains downstream pressure as designed while flowing water and once returned to static state.<br>- Record downstream pressure and flow point on a form listing all pressure reducing valves, their location and area controlled.<br><br>CAUTION: In high rise buildings, ensure the capacity of the drain riser is such that partial flow testing of the system can be conducted. Failure to do so can create a backup of water within the drain that can potentially exceed the design of the piping. |
| 1c | Conduct full flow testing of pressure reducing valves | 5-years | - Establish flow through the pressure reducing valve by flowing the main drain that is located downstream of the pressure reducing valve. This main drain should be opened slowly until fully open.<br>- While opening the main drain, monitor the downstream pressure and confirm that the valve maintains downstream pressure as designed while flowing water and once returned to static state.<br>- Record downstream pressure and flow point on a form listing all pressure reducing valves, their location and area controlled.<br><br>CAUTION: In high rise buildings ensure the capacity of the drain riser is such that full flow testing of the system can be conducted. Failure to do so can create a backup of water within the drain that can potentially exceed the design of the piping. |

2.4.1.3 Investigate changes in the recorded inlet and outlet pressures of the pressure reducing valve.

2.4.1.4 Investigate and correct any malfunction of a pressure reducing valve promptly.

## 3.0 SUPPORT FOR RECOMMENDATIONS

### 3.1 General

In fire protection service, pressure reducing valves can be found in many places including on standpipes, in sprinkler systems, on underground piping, and on gravity water systems. Other uses may exist if warranted by specific local conditions. Their goal is to reduce a higher upstream pressure to a lower downstream pressure.

One common application of pressure reducing valves is in the connection for hose and sprinkler systems in combined standpipe/sprinkler system risers in high-rise buildings. In these combined systems, pressure reducing valves are used to keep maximum pressures at the hose connections and the maximum static pressure in sprinkler system components within the limits given in Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

Automatic breach containment valves (ABCVs)can be seen in fire protection systems, potable water systems, and chilled water circulation.

A common application for these valves is in high-rise building fire protection systems. Upon detection of a breach condition, defined in the manufacturer's literature as being a "catastrophic breach" where "excessive flows" result, the ABCV closes completely and water tight. Once closed the valve isolates the damaged portion of the fire protection water supply. Manufacturers of these valves state this allows continued service in other areas and prevents gravity from draining fire water reserves.

Catastrophic breach conditions are extremely rare occurrences. As ABCV's are designed to operate only when breach conditions occur, they have no impact on any flow of water less than the breach flow conditions to which they are set. As such these valves do not address the most common forms of water damage, from flows that are much less than a line break or breach condition. FM loss history has shown a key driver for liquid losses is an undetected leak that runs for an extended period, resulting in a larger accumulation of liquid and mold growth due to the resulting dampness. For all liquid losses seen in a recent 10-year period, 42% of all losses seen involving escaped liquids were of this type.

Sprinkler systems for fire protection are designed to function by flowing water. Hence installing a device that is designed to close even in a specific situation, introduces a element of unreliability into a fire protection system to which it is attached. If the valve closes in any condition other than a full breach, downstream fire protection will be impaired thereby resulting in a much larger event.

## 3.2 Types of Pressure Reducing Valves

### 3.2.1 Pressure Reducing Valve, Direct-Acting Type

Direct-acting type pressure reducing valves utilize an internal spring that exerts force directly against the valve seat assembly. Pressure reducing control is achieved via an internal control chamber which senses outlet pressure and applies a force to the valve seat assembly opposite the internal spring. The outlet pressure is adjusted by increasing or decreasing the spring compression. Direct-acting type pressure reducing valves are typically equipped with a handwheel type manual close feature that bypasses the spring and control chamber to close the valve. These valves are typically used as zone control valves within a sprinkler system.

### 3.2.2 Pressure Reducing Valve, Pilot-Operated Type

Pilot-operated pressure reducing valves utilize a diaphragm type automatic control valve equipped with an adjustable trim pilot valve. Water flows into the diaphragm control chamber from an inlet sensing port with exit flow through the outlet sensing port controlled by the trim pilot valve. The outlet pressure is adjusted by increasing or decreasing the spring compression within the pilot valve via adjusting screw.

### 3.2.3 Automatic Breach Containment Valve

Automatic breach containment valves are pilot-operated, pressure reducing valves, that operate in a similar manner. By utilizing a pressure differential across the valve seat, these valves will close water-tight once the pressure differential is exceeded. Water is therefore prevented from passing through the valve into any downstream systems.

## 3.3 Sizing and Selection of Pressure Reducing Valves

Brass or bronze valves are preferred to minimize long term corrosion attack and mineral deposit buildup on these valves. Epoxy coating of iron valves is an alternative to the brass or bronze valves; however, the protective coating may be subject to damage by rocks or other debris in the pipeline.

Some direct-acting pressure reducing valves are tagged with a "set pressure" and must be installed at the factory-designated floor; this tag should not be removed nor should the valve be installed in any other location without factory agreement.

In general, the ability to have pressure gauges both upstream and downstream of the valve for setting and checking the pressure settings on the valve are desirable, should the valve malfunction.

Potential issues can result if reverse water flow through a pressure reducing valve or a breach containment valve occurs. Common methods of this occurring include connection to alternative water supplies or via fire department water connections. Correct installation of the valve should eliminate this potential issue.

Large pressure reducing valves may not provide accurate pressure regulation or may cavitate at low water flow rates. Thus, it may be necessary to provide a smaller (secondary) pressure reducing valve in parallel with the primary pressure reducing valve. The secondary pressure reducing valve should be capable of regulating the pressure in the range of flows from “no flow” up to about 2 times the minimum flow 20% of the maximum flow rate capacity of the main valve. The main (primary) pressure reducing valve should be capable of regulating the pressure in the range of the upper limit of the secondary pressure reducing valve up to the maximum water demand. Each installation should be carefully engineered, taking into consideration the water supply, the water demand and the characteristics of the particular pressure reducing valves. If necessary, consult with the valve manufacturer to ensure correct valve settings and installations.

Correct sizing of a pressure reducing valve is an important step in system design. Under static condition a pressure reducing valve needs to be able to prevent outlet static pressures from exceeding the rated pressure of system components, or the maximum allowed system pressures given by Data Sheet 2-0. Under flowing conditions, the valve needs to be able to use the available inlet supply pressures to deliver the flow ratesp and outlet pressures required by the fire protection system(s) being supplied through the valve.

Consider the following when sizing pressure reducing valves:

- The maximum available inlet static pressure
- The maximum allowable outlet static pressure
- The minimum available inlet residual pressure
- The minimum required outlet residual pressure
- The range of required flow rates through the valve
- The different water supplies available for the system

The maximum available inlet static pressure at the valve is a function of the maximum static pressure of the water supply and the elevation of the valve.

The maximum allowable outlet static pressure is a function of the pressure rating of system components or code regulations.

The minimum available inlet residual pressure at the valve is a function of the minimum static pressure of the water supply, the elevation of the valve, and the friction loss calculated for the maximum flows expected in the operation of the piping system supplying the pressure reducing valve, e.g., the standpipe system in high-rise buildings.

The required residual outlet pressure at the valve is a function of the water demand and hydraulics of the system being supplied through the pressure reducing valve.

### 3.3.1 Sizing Direct-Acting Pressure Reducing Valves

The valve size and setting selected must be able to perform two functions:

A. Limit the outlet static pressure to acceptable levels.

B. Handle the water demands of the system within the range of inlet pressures available at the valve.

Sizing of direct-acting pressure reducing valves is based on flow charts available from the manufacturer of the valve. It is customary for manufacturers of direct-acting valves to provide flow charts showing a plot of the outlet pressure versus the inlet pressure for a given flow rate through the valve (Figure 3.3.1-1). In these graphs, each curve represents the performance of the valve at a given pressure setting.

Other manufacturers provide flow charts that show a plot of the outlet pressure versus the flow rate through the valve for a given inlet pressure range or condition (Figure 3.3.1-2). This type of chart gives better indication of the valve performance than the previously described “inlet pressure vs. outlet pressure” charts.

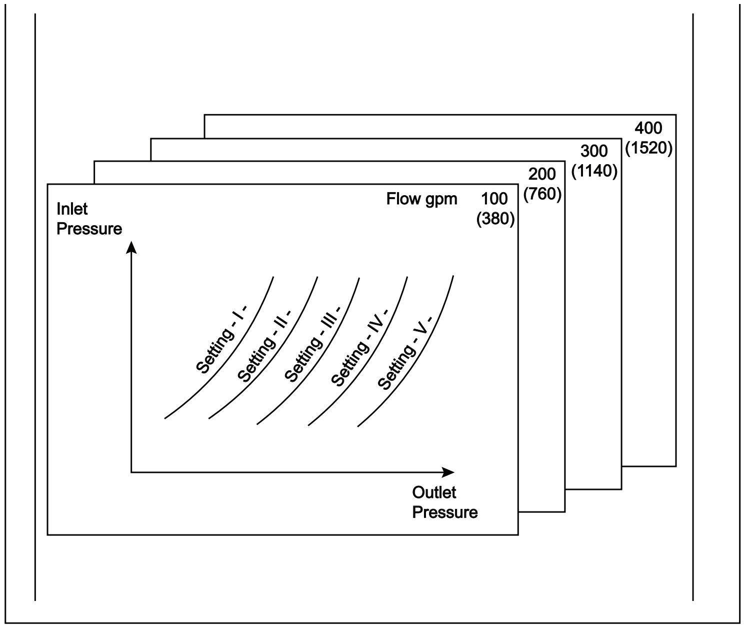


*Fig. 3.3.1-1. Flow chart showing pot of outlet pressure versus inlet pressure for a given flow rate.*

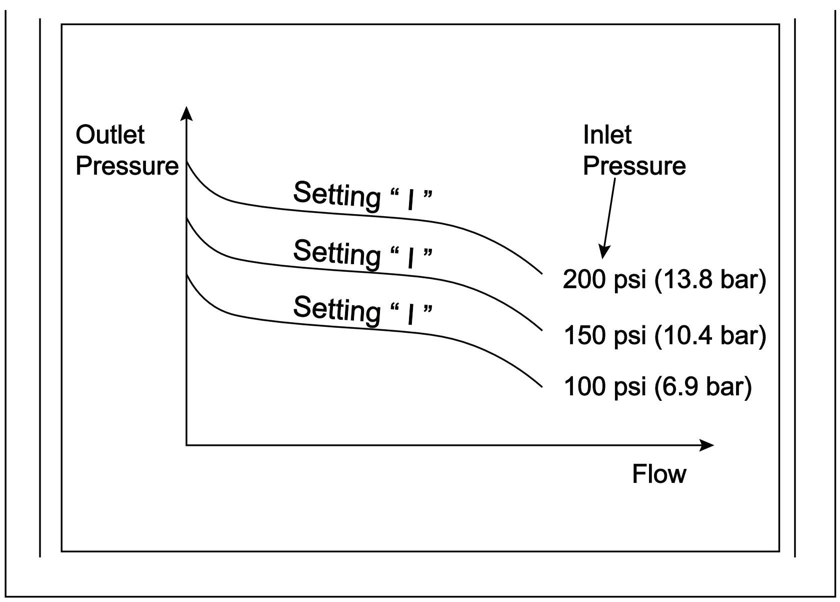


*Fig. 3.3.1-2. Flow chart showing plot of outlet pressure versus flow rate through the valves for a given inlet pressure range*

### 3.3.2 Sizing Pilot-Operated Pressure Reducing Valves

Similar to direct-acting valves, pilot-operated valves should be sized and set to handle both the minimum and maximum water demands of the system, and to prevent excessive outlet static pressures. The valve should be sized appropriately based on its maximum flow rate capacity, to avoid instability, system oscillation and damage to the seat and trim caused by localized high velocities, and to ensure adequate differential across the valve so that the valve can provide quick controlled response. In some systems where there is a wide flow range, parallel installation of two or more valves may be required. In a system where a large pressure drop is needed, installation of two or more valves in series may be necessary.

Sizing of the valves is done with the aid of “high” and “low” flow sizing graphs as shown in Figure 3.3.2-1. These charts show a plot of the maximum pressure drop across the valve as a function of the flow rate. Charts and sizing instructions can be obtained from the manufacturer of the valve.

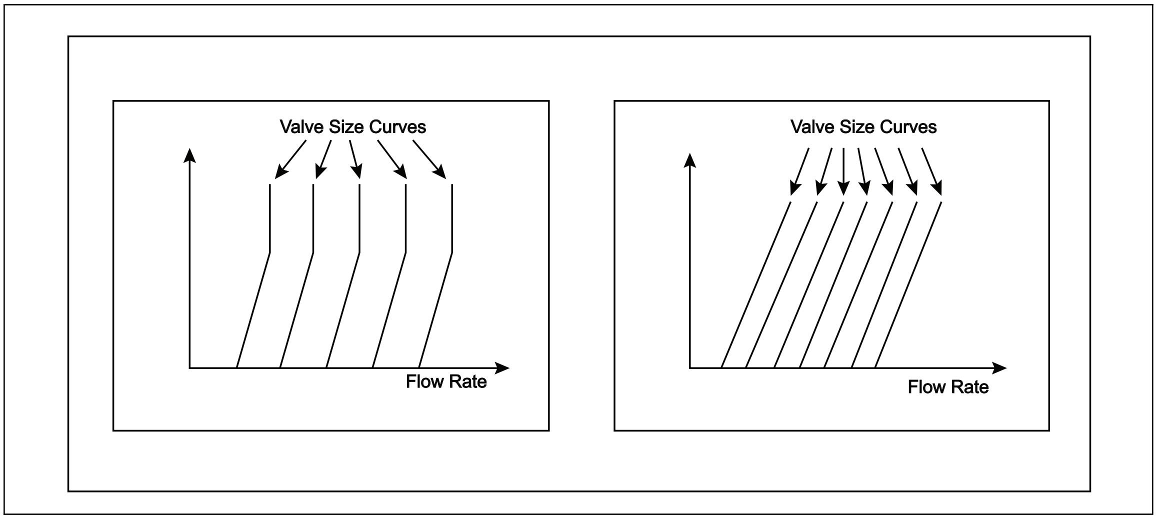


*Fig. 3.3.2-1. Flow sizing graphs showing plot of maximum pressure drop across valve as a function of flow rate*

### 3.3.3 Sizing Drains and Relief Valves

The purpose of the pressure relief valve is to help the pressure reducing valve to close. Flow through the pressure relief valves also will cause the water flow alarm on sprinkler systems to sound, alerting building occupants of the problem with the pressure reducing valve. Properly designed drains will accommodate the flows required during testing of the pressure reducing valves.

## 3.4 Illustrative Losses

3.4.1 Direct-acting field-adjustable pressure reducing valves installed at hose connections of this high-rise building were improperly set for low outlet pressures. The poor hose streams resulted in ineffective firefighting operations in the building. All 2-1⁄2 in. (64 mm) direct-acting field adjustable pressure reducing valves installed in hose connections at the 22nd, 23rd and 24th floors of this 38-story high-rise building were improperly set, resulting in low water pressure for the fire hoses. When a fire broke out on the 22nd floor of the building, fire fighters attempted to improve the quality of hose streams for over 4 hours. Hose streams were only improved when a contractor was called to the site to change the setting of the valves to a higher setting. The fire spread to the 30th floor. On the 30th floor the existing sprinkler system, supplied by the fire department pumper trucks, brought the fire under control. (NFPA Fire Journal, Sept./Oct. 1991, pp. 66)

3.4.2 A direct-acting pressure reducing valve installed in a hose connection of a high-rise building failed to operate properly, allowing high pressures to the fire hose and preventing fire fighters from opening their nozzles all the way during fire-fighting operations. A 2-1⁄2 in. (64 mm) direct-acting pressure reducing valve installed on the hose connection at the 15th floor of a 62-story high-rise building reportedly allowed too high pressures to the fire hose. When a fire broke out in the building, the high water pressures made the hose line unmanageable to fire fighters and prevented spray nozzles from being fully opened. Subsequent examination of the valve showed that its diaphragm had been forced out of position along the edge, resulting in the valve not functioning as designed.

3.4.3 Improperly sized drain causes water leakage loss when a direct-acting pressure reducing valve failed in a domestic water line. A cracked brass seat inside a domestic water line pressure reducing valve caused the domestic line on the upper floors of this office building to be over pressurized. The excess pressure sustained to the water line caused one water line relief valve and two water tank relief valves to operate. Water discharging from the relief valve overflowed local drains and wetted floors, ceilings, walls and equipment on four floors of the building.

## 4.0 REFERENCES

### 4.1 FM

Data Sheet 1-24, *Protection Against Water Damage*
Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*
Data Sheet 3-7, *Fire Protection Pumps*
Data Sheet 3-26, *Fire Protection for Nonstorage Occupancies*

### 4.2 Other

National Fire Protection Association (NFPA) *Fire Journal*, Sept./Oct. 1991, pp. 66.

## APPENDIX A GLOSSARY OF TERMS

**Angle valve:** A manually operated valve with its outlet opening oriented at right angles to its inlet opening; used for regulating flow of a fluid in a pipeline.

**Automatic breach containment valve (ABCV):** An hydraulically operated valve. Operating by pressure differential across the valve they are designed to close and thus isolate water distribution piping in the event of a catastrophic downstream breach or line break. These are sometimes referred to as Automatic Breach Control Valves.

**Direct-acting valve:** A valve in which the position of the valve (disk) is controlled directly by the reaction of a mechanism acting on the stem of the valve (typically a pre-loaded spring) to any changes in inlet and outlet pressures of the system.

**FM Approved:** Products and services that have satisfied the criteria for FM Approval. Refer to the Approval Guide for a complete listing of products and services that are FM Approved.

**Factory set:** Pressure reducing valves that have their outlet pressure set by the manufacturer and do not allow any adjustment of the set pressure in the field. This term generally applies to direct acting pressure reducing valves only.

**Field set:** Pressure reducing valves that allow field adjustments of the manufacturer’s set pressure, also called “Field Adjustable.” This term applies to direct acting and pilot operated pressure reducing valves.

**Full flow test:** A flow test through the valve at multiple flow points within the specified range of the valve. Typically points would include the lowest flow, midrange flow and highest flow points within its operational curve.

**Globe valve:** A device for regulating flow in a pipeline consisting of a movable disk-type element and a stationary ring seat in a generally spherical body. Globe valves are closing-down valves in which the closure disk-type member mentioned above is moved squarely on and off its seat. By this mode of disk travel, the seat opening varies in direct proportion to the travel of the disk, thus making the valve ideally suited for tasks where regulation of the flow rate is required.

**Inlet pressure:** Pressure acting on the inlet side of the valve, also referred to as upstream pressure.

**Outlet pressure:** Pressure acting on the outlet side of the valve, also referred to as reduced pressure or downstream pressure.

**Partial flow test (operational test):** A flow test through the valve at any point within its specified range of flows. Partial flow tests are used to verify the pressure settings of the valves and ensure the valve is operating within normal parameters.

**Pilot-operated valve:** A valve that is controlled by a pilot mechanism that senses the inlet and outlet pressures in the pipeline where the valve is installed, and pilots the main valve open or closed. Other terms used for pilot operated pressure reducing are flow control valves or pressure control valves.

**Pressure Reducing Valve:** a valve used to reduce high inlet fluid pressures (water in the case of valves used in the fire service) to a lower outlet pressure in both the static (no-flow) condition and the residual (flowing) condition. These valves are referred to using the acronym “PRV”.

**Pressure Relief Valve:** an automatic opening valve that will react to pressure buildup and relieve the pressure to atmosphere by opening when the pressure exceeds a set limit. The valve re-closes when the abnormal pressure drops below the set limit. The acronym “PRV” is never applied to pressure relief valves. PRV is reserved for use when referring to pressure reducing valves.

**Reduced pressure fall off:** The decrease in outlet pressure that occurs when the flow passing through the pressure reducing valve increases.

**Residual pressure:** The pressure head acting at a given point of the system with flow being delivered by the system.

**Set pressure:** The definition of set pressure varies according to the type of valve, as follows:

- For direct-acting pressure reducing valves, the setting of the valve may be given as a code or letter that specifies the performance of the valve for a given flow condition. When a specific value of pressure is given as the valve “set pressure,” this may refer to the maximum outlet static pressure of the valve.
- For pilot operated pressure reducing valves, it is the outlet residual pressure for which the pilot regulator of the valve has been adjusted and is expected to maintain, regardless of changing flow rate and varying inlet pressures.

**Standpipe:** In a multi-story building, it is the riser portion of the fire protection piping system that delivers the water supply for hose connections and sprinklers vertically from floor to floor. A standpipe that supplies both hose connections and sprinkler systems is called a combination standpipe.

**Static Pressure:** The pressure head acting at a given point of the piping system with no flow being delivered by the system.

## APPENDIX B DOCUMENT REVISION HISTORY

The purpose of this appendix is to capture the changes that were made to this document each time it was published. Please note that section numbers refer specifically to those in the version published on the date shown (i.e., the section numbers are not always the same from version to version).

**January 2023.** Interim revision. Changes include the following:

A. Renamed Section 2.3 to Protection.

B. Relocated existing sections 2.2.2 and 2.2.3 to Section 2.3, Protection.

C. Updated installation guidance for pressure reducing valves in system designs.

D. Updated requirement for flow and pressure testing where pressure reducing valves are installed.

E. Changed the inspection and testing requirements in Table 2.4.1.2-1.

F. Minor editorial corrections.

**July 2022.** Interim revision. Significant changes include the following:

A. Guidance on the orientation of valves was updated. Installation is to be as per OEM instructions.

B. Section 2.2.2.5 was updated to clarify access to valve adjusting tools is to be controlled when these tools are kept on site and used by site personnel.

C. Section 2.3.1.7 was updated. Other testing methods, besides installing a physical drain, are acceptable if they are appropriately sized.

**October 2021.** This document has been completely revised. Significant changes include the following:

A. Changed the title of the data sheet to “Flow and Pressure Regulating Devices for Fire Protection Service.”

B. Revised the scope to clarify the hazards covered.

C. Revised guidance for the installation and construction of pressure reducing valves.

D. Revised inspection, testing, and maintenance guidelines for pressure reducing valves.

**April 2015.** Interim revision. Figure 8, Form 2702, Annual Performance Test Record of Pressure Reducing Valves, was updated and editorial changes were made.

**September 2000.** This revision of the data sheet has been reorganized to provide a consistent format.

**February 1995.** First Issue.

## APPENDIX C FORMS

### ANNUAL PERFORMANCE TEST RECORD FOR PRESSURE REDUCING VALVES (PRV)

FM Global

| Property Name | Index Number | Account Number |
|---|---|---|
| Property Address | Operations Center Location | |

**INSTRUCTIONS**

1. Conduct a Full Flow Test on each PRV on site in accordance with FM Global Data Sheet 3-11.
2. Use a separate form for each valve.
3. Keep a copy of form on site for review of test record.

| Valve Manufacturer's Name / Year Installed | Model Number | Type of Valve | Installation At: |
|---|---|---|---|
| Valve Manufacturer's Name<br>Year Installed | Model Number | ☐ Pilot Operated<br>☐ Direct Acting | ☐ Sprinkler System<br>☐ Hose Connection<br>☐ Fire Main<br>☐ Other |

| Date & Initials | Location of Valve (e.g. Floor No. Standpipe No.) | Valve Setting Per Manufacturer Specs. | Static Pressure | | Residual Pressure | | Flow Rate (gpm) | Performance S=Satis. U=Unsatis. | Red Tag Permits Used | | Comments/ Corrective Action Needed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inlet (psi) | Outlet (psi) | Inlet (psi) | Outlet (psi) | | | Yes | No | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |
| | | | | | | | | | ☐ | ☐ | |

The FM Global *RED TAG PERMIT SYSTEM* is used to guard against shut valve fires, and should be used every time a sprinkler control valve or pressure-reducing valve is closed. When the valve is reopened, a downstream main drain or waterflow alarm test connection should be flowed to confirm the valve has been reopened. The valve should then be relocked in the full-open position.

| Were any valves closed since the last inspection? ☐ Yes ☐ No | |
|---|---|
| If inspected by Contractor (Contractor's Name) | Signature: |
| Address | Date: |
| Reviewed By: | Date: |

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*Fig. C-1. Form 2707, Annual Performance Test Record of Pressure Reducing Valves*